

RESEARCH ARTICLE

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Determinants of exclusive breastfeeding practice among mothers with infants under six months in Ethiopia: A Multilevel Analysis of the 2019 Ethiopian Mini Demographic and Health Survey

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ABSTRACT

Background: Exclusive breastfeeding (EBF) is defined as feeding infants only breast milk, either directly from the breast or expressed, with no other foods or liquids except prescribed drops or syrups consisting of vitamins, mineral supplements, or medicine. However, the prevalence of EBF in Ethiopia is lower than the internationally recommended level. Most previous studies on EBF in Ethiopia have focused on individual-level factors, covered limited geographic areas, used small sample sizes, and relied on binary logistic regression analysis of older datasets. The main objective of this study was to identify the determinants of EBF practice among Ethiopian mothers of infants under 6 months old.

Methods: The 2019 Ethiopian Mini Demographic Health Survey (2019 EMDHS), a recent nationwide community-based cross-sectional survey, was used as the primary data source. A multilevel logistic regression model was used to identify individual and community-level factors significantly associated with EBF among infants under 6 months of age. An adjusted odds ratio (AOR) with 95% confidence interval (CI) was used to measure the association between factors and EBF practices. Log-likelihood (LL), deviance, and Akaike Information Criterion (AIC) were used for the model comparison.

Results: This study included 531 weighted infants aged < 6 months. The prevalence of EBF practice was 83%. Mothers with higher education (AOR: 0.02; 95% CI: 0.001, 0.64) and infants from middle-class or wealthy family backgrounds (AOR: 5.34; 95% CI: 1.022, 27.85) were significantly associated with EBF practice among under-6-month-old infants. Rural residence (AOR: 0.08; 95% CI: 0.01, 0.99), pastoral regions (AOR: 0.03; 95% CI: 0.003, 0.18), and low community poverty level (AOR: 0.11; 95% CI: 0.018, 0.68) were also significantly associated with the practice of EBF among infants under 6 months old.

Conclusion: In this study, mothers' educational level, wealth index, place of residence, contextual region, and community poverty level were significant factors affecting EBF practices among infants aged 6 months or younger. Creating awareness about poverty and the value of EBF at the community level may help enhance exclusive breastfeeding practices.

Keywords: Exclusive breastfeeding, infants under 6 months, multilevel logistic regression, Ethiopia

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INTRODUCTION

Exclusive breastfeeding means that an infant receives only breast milk from his or her mother, be it directly from the breast or expressed, with no other foods or liquids except prescribed drops or syrups consisting of vitamins, mineral supplements, or medicine (1). EBF is the highly recommended feeding option of infants for the first six months of their lives because it is safe, healthy, uncontaminated, and contains all necessary nutrients (2). In addition, the EBF also serves as the leading immunization for infants' various diseases including diarrheal disease, respiratory infections, and life-threatening illnesses (3). In later life, it is also important to prevent the risk of developing diarrheal infections, pneumonia, obesity, and chronic diseases such as type II diabetes (1, 4, 5). Similarly, breastfeeding also helps to strengthen the physical and spiritual bond between mothers and their children (6). The World Health Organization (WHO) recommends early newborn breastfeeding initiation within one hour of birth, exclusive breastfeeding for 6 months, and continued breastfeeding for 2 years or more in conjunction with complementary foods (2, 7, 8). Between 2013 and 2018, 43% of newborns were initiated on breastfeeding within one hour of birth. The evidence from the WHO report showed that 41% of infants under the age of 6 months are breastfed exclusively (9). In developing countries and Africa, the prevalence of exclusive breastfeeding among infants under the age of 6 months were 39% and 37%, respectively (10, 11). In the two years preceding the survey in Ethiopia, nearly every child (96%) was breastfed at some point. But only 59% of babies younger than six months are fed just breast milk (12).

There hasn't been much progress, despite the Ethiopian government's best efforts to encourage and enforce exclusive breastfeeding for babies under six months of age. The Ethiopian national figure shows that only a 1% increase from 2016 (58%) to 2019 (59%)(12).

This low rate of increase could be due to various contributing characteristics which may be related to socio-economic, demographic, obstetric and health care factors related to infant and mother such as: age of the infant, its sex, birth order, time of initiation, birth interval, age of the mother, sex of the head of the household, marital status,

maternal educational level, religion, household wealth index, family size, counseling service, type of birth, antenatal care (ANC), postnatal care (PNC), place of delivery, mode of delivery, and place of residence (3, 4, 11, 13-24).

Studies have indicated various factors that could significantly influence EBF practices. Studies conducted in Ethiopia showed that female infants (22), infants aged 0-1 month and 2-3 months (16, 25), being a single birth (16), breastfeeding initiation within one hour of birth (16, 17), mothers having secondary and higher education (19, 20, 23), women age 25-34 years (20), married mothers (18, 20), richer household wealth index (21, 22, 25), mothers having ANC visits (16, 18, 19, 21, 22, 26, 27), mothers having postnatal care checkup (13, 16, 18, 21, 23, 26), deliveries at health facilities (13, 19, 20, 23, 26, 28) receipt of breastfeeding counseling (17, 18, 25, 27, 28), and urban residence (20) were positively associated with EBF practice among under-6 month infants. Contrary studies conducted in Ethiopia showed that children aged 4-5 months (15), urban residence (19, 26), women age 35 - 49 years (24), family size of more than 5 (19, 20), caesarean births (15, 19, 21), higher household wealth status (14, 20), residing in Afar region (15), and residing in Somali region (24) were negatively associated with EBF practice among under-6-month infants. Contextual region (22), community level of postnatal visit (22), and community level of maternal employment (22) were significantly associated determinants of EBF at the community level.

Most of the previous studies in Ethiopia mainly focused on individual-level factors covering limited areas with a small sample size, and the method of analysis was also a binary logistic regression model. But EBF practice was influenced by both individual and community-level factors. In the case of nested data, the assumption of independence among individuals within the same cluster, as well as the assumption of equal variance across different clusters, are not upheld. As EMDHS data is hierarchical, and the community level factors have their own contribution to breastfeeding practice of infants under 6 months of age, a multilevel logistic regression model with recent data is preferred to consider the individual and community-level factors at the same time. There are also limited studies in the proposed model. The results of this study will help policy makers, the government, stakeholders, and local authorities.

METHODS

Study setting

The study was carried out in Ethiopia, which is located in North Eastern part of Africa. Contextually, the country is categorized as agrarian (Tigray, Amhara, Oromia, SNNP, Gambella, Benshangul Gumuz), pastoralists (Somali, Afar), and city-based population (Addis Ababa, Diredawa, Harari) (29, 30).

Data source and study design

The 2019 Ethiopian mini-DHS (EMDHS) data were used for this study. The survey was conducted by the Ethiopian Public Health Institute (EPHI) in collaboration with the Central Statistical Agency (CSA) and the Federal Ministry of Health (FMOH). The nationally representative 8,855 women of reproductive age (age 15-49) from 8,663 households were collected from 21 March 2019 to 28 June 2019. A stratified, two-stage cluster random sampling was used in this study. Enumeration areas (EAs) were the sampling units for the first stage of the 2019 EMDHS sample, where 305 of them were randomly drawn. In the second stage, representative samples of households were chosen. The EMDHS 2019 was a recent nationwide community-based cross-sectional survey.

Study variables

Outcome variable

The exclusive breastfeeding (EBF) practice is an outcome variable, which is categorized as: 1: a mother did not feed the infant/baby anything else except syrup and medicine apart from milk in the first 6 months after birth and 0 otherwise. Mothers who have less than 6 months old children during the data collection period were asked about whether they fed breast milk without anything else in the last 24 h preceding the survey, except for oral rehydration salt, syrups, and others therapeutic purposes. As WHO recommendations, exclusive breastfeeding for infants should be practiced for the first 6 months.

Independent variables

Two sets of explanatory variables (individual and community level) were included in this study. The individual level variables were taken from infant and their mothers based on the review of different studies. Therefore, the infant related variables are age of infant (0-1 month, 2-3 months, 4-5 months),

sex of child (male, female), birth order 1st, 2nd-3rd, 4th and above), time of breastfeeding initiation ($\leq$ 1h, $>$ 1h), birth interval ($\leq$ 24 hours, $>$ 24 hours) whereas the maternal socio-demographic and obstetric & healthcare related characteristics are age of mothers in years (15-19, 20-34, 35-49), sex of head of the household (male, female), marital status (never in union, currently in union, widowed/divorced), maternal education (no education, primary, secondary, higher), religion (orthodox, protestant, muslim, others), region, household wealth index (poor, middle/rich), household family size ($\leq$ 5, $>$ 5), counseling on breastfeeding during the first 2 days of a birth (no, yes), type of birth (single, multiple), ANC visit (no, 1-3, 4+), PNC visit within 2 months (no, yes), place of delivery (home, health facility), and caesarian delivery (no, yes).

Moreover the community level variables such as place of residence (urban, rural), contextual region (Agrarian, Pastoralist, City based)(29, 30), community ANC (low, high), community PNC (low, high), community poverty (high, low) and community education (low, high) were also included in this study.

Community-level metrics variables were computed by combining the individual characteristics within a cluster, as the EDHS did not gather data that could specifically represent the characteristics of those clusters. The aggregates were determined using the proportion of each subcategory of a given variable. Because the aggregate values for all the created variables do not follow a normal distribution, they were classified into categories based on national median values and prior research studies(15, 29).

The utilization of community ANC was measured by the percentage of mothers in a given cluster who attended ANC a certain number of times. This was classified according to national quartiles into low ANC utilization communities (when 50% or fewer women are utilizing ANC) and high (when more than 50% of women are utilizing ANC)(29).

The community level of PNC utilization refers to the percentage of women within a particular cluster who access PNC services a certain number of times. This was classified as low when 50% or fewer women utilized PNC, and high when more than 50% of women utilized PNC(29).

The community level of poverty was an aggregate wealth index categorized as “ $<$ 50% = High” and “ $\geq$ 50% = Low pov-

erty communities”(29).

Community level of women’s education: the proportion of women in the community who had primary or higher education, which was categorized as low (when $\leq 50\%$ of women

Were educated) and high (when $>50\%$ of women were educated)(29).

Statistical data analysis

Data analysis was done using Stata Version14. The data management, such as recoding, renaming and verification were done. To select the candidate variables for final model variable multilevel mixed effect logistic regression model was employed. The multilevel mixed effect logistic regression model was conducted for those variables and a p-value less than 0.05. In a multilevel mixed effect logistic regression model, the adjusted odds ration with 95% confidence interval and p-value less than 0.05 were used to identify the most significant factors influencing EBF among under 6-month infants. The assumptions of the model: the presence of multicollinearity among independent variables using variance inflation factor (VIF), categories of the categorical variables using classification table and the model goodness of fit using Hosmer and Lemeshow were checked. It was found that VIF values of all variables were less than 10, which implies that there was no multicollinearity among independent variables. Since the EMDHS data are hierarchical (individual were nested within communities), a two-level mixed effects logistic regression model was fitted to estimate both the individual and community level variables (fixed and random) effects on exclusive breastfeeding practices.

Bi-variable and multivariable analysis were computed. In the bi-variable logistic regression, a p-value of less than 0.25 was used to fit three models (Model I: individual level, Model II: community level, Model 3: both individual and multilevel). A total of four models were considered in the multilevel analysis to determine the model which best fits the data; Model I (Null model) without independent variable was employed to evaluate the cluster level, enumeration area, difference in exclusive breast-feeding practice. Model II adjusted for individual level variables to know the contribution of determinants to explain the exclusive breast-feeding practices. Model III used to evaluate the effect of community-level factors on breast feeding practice of mothers in Ethiopia. Model IV were included in the model to predict the contribution of both individual and community level factors on breast feeding practices.

On the analysis of the model, if the variables had a p-value ≤ 0.05 with confidence interval not including the null value (OR=1) were considered as statistically significant variables with EBF practice.

The measures of variation (random effects) between clusters were reported using Intra Cluster Correlation (ICC), Median Odds Ratio (MOR), and Proportional Change in Variance (PCV). The ICC refers to the ratio of the between-cluster variance to the total variance, and it tells us the effect community characteristics on exclusive breastfeeding practices of infants under six months of age in Ethiopia. The ICC can be

defined as $ICC = \frac{\sigma^2_u}{\sigma^2_u + \sigma^2_e}$ or $ICC = \frac{\sigma^2}{\sigma^2 + \frac{\pi^2}{3}}$, where $\sigma^2_u =$ between group variation, $\sigma^2_e =$ within group variation, and σ^2 is the estimated variance of the clusters.

MOR is computed as median value of the odds ratio between the randomly selected two areas, the area at the highest likelihood of breast-feeding practice and the area at the lowest likelihood of breast-feeding practice. $MOR = \exp\sqrt{(2\sigma^2 + 0.6745)} \approx \exp(0.95\sigma)$

. The proportional change in variance can be calculated as $PCV = \frac{VA - VB}{VA} \times 100\%$,

where $VA =$ variance of initial model and $VB =$ variance of model with more terms measures the total variation attributed by individual and community level factors in the multilevel model. PCV was computed for each model as compared to the null model to know the power of the determinants in the model explains exclusive breast feeding.

The log-likelihood, Akaike Information Criteria (AIC), and deviance were used to select the best model. The model with the highest value of the log-likelihood and with the lowest values of the deviance and AIC was considered to be the best fit model.

RESULTS

Prevalence of EBF

In this study a total of 567 infants under six months of age were included in the 2019 EMDHS survey. After weighting the sample size became 531. The prevalence of the exclusive breastfeeding infants less than 6 months of age was 83%.

Background characteristics of infants

The average age of infants and their mothers were 2.69 months and 27.76 years, respectively. More than half

(53.67%) of the infants were female. Majority (84.76%) of the infants were initiated breastfeeding within 1 h of birth.

Table 1: Background characteristics of infants in Ethiopia, EMDHS 2019 (n=531)

Variables	Categories	Unweighted Frequency n(%)	Weighted frequency (%)
Age of infant	0 – 1 month	193 (34.04)	165(31.15)
	2 - 3 months	171 (30.16)	156(29.35)
	4 - 5 months	203 (35.80)	210(39.51)
Sex of child	Male	270 (47.62)	246(46.33)
	Female	297 (52.38)	285(53.67)
Birth order	1 st	131 (23.10)	110(20.64)
	2 nd to 3 rd	186 (32.80)	173(32.63)
	4 th and above	250 (44.09)	248(46.73)
Time of breastfeeding initiation	<= 1h	466 (82.19)	450 (84.76)
	>1h	101 (17.81)	80 (15.24)
Birth interval	<= 24 months	79 (18.20)	68 (16.14)
	>24 months	355 (81.80)	353 (83.86)

381(71.79%) of mothers were in the age group of 20-34. Only 62 (11.74%) females were head of the household. Most mothers, 502 (94.67%), participated in this study were in union at the time of the survey. Regarding to the maternal education level, almost half (49.75%) of, 192 (36.17), 55 (10.46) and 19 (3.62) had no education, primary, secondary, and higher education, respectively. About one third (33.96%) of mothers were orthodox Christians followers. Nearly half (46.87 %) of mothers were poor wealth indices, more than half (26.84 %) of them had family size of less than six. About 184 (34.75) of mothers had a counseling service on breastfeeding by health provider during first 2 days of a birth.

Almost all of mothers (99.11%) had a single type of birth. The majority (70.90%) of the women had antenatal care (ANC) visit for their recent pregnancy. Of those who had ANC visits, 42. 75% had four and more times visits, and only 28.15% % visited before the third month for their first antenatal care. Only 56 (10.61) mothers had a postnatal care checkup within 2 months at the time of pregnancy. Regarding with the place of delivery, more than half (53.57 %) mothers were delivered

at health facilities. Only 34 (6.48 %) of mothers gave births by caesarian mode of delivery.

Community level factors

In this study, more than three-fourth (76.70%) of mothers were rural residents. The proportion mothers, about 471 (88.74 %), 42 (7.94 %), and 18 (3.32 %) were from Agrarian, Pastoralist, and City based regions, respectively. Nearly half (44.06 %) of mothers had low community ANC utilization. Regarding to community postnatal care utilization about, 411 (77.38 %) of the mothers had low community postnatal care utilization. About 242 (45.54 %) of the respondents were from high poverty level of the community. Similarly, more than half of the mothers, about 286 (53.80 %) of them belongs to low community educational level.

In this study the prevalence of exclusive breastfeeding among infants under-six months of age was 83 % with 95% CI of (54.6, 60.2).

Table 2: Background characteristics, maternal obstetric and health care related characteristics of mothers in Ethiopia, EMDHS 2019 (n=531)

Variables	Categories	Unweighted Frequency n(%)	Weighted frequency (%)
Age of mother in years	15 -19	66 (11.64)	52 (9.70)
	20-34	417 (73.54)	381(71.79)
	35-49	84 (14.81)	98 (18.51)
Sex of head of the household	Male	468 (82.54)	469 (88.26)
	Female	99 (17.46)	62 (11.74)
Marital status	Currently not in union	23 (4.06)	28 (5.33)
	Currently in union	544 (95.94)	503 (94.67)
Maternal education	No education	278 (49.03)	264 (49.75)
	Primary	194 (34.22)	192 (36.17)
	Secondary	64 (11.29)	56 (10.46)
	Higher	31 (5.47)	19 (3.62)
Religion	Orthodox	157 (27.69)	180 (33.96)
	Protestant	107 (18.87)	129(24.35)
	Muslim	303 (53.44)	221 (41.69)
Region	Tigray	56 (9.88)	44 (8.34)
	Afar	66 (11.64)	9 (1.72)
	Amhara	44 (7.76)	92 (17.37)
	Oromia	73 (12.87)	226 (42.52)
	Somali	60 (10.58)	33 (6.21)
	Benishangul	51 (8.99)	7 (1.23)
	SNNPR	58 (10.23)	100 (18.74)
	Gambela	49 (8.64)	3 (0.54)
	Harari	43 (7.58)	2 (0.3)
	Addis Ababa	25 (4.41)	13 (2.44)
	Dire dawa	42 (7.41)	3 (0.58)
	Poor	294 (51.85)	249 (46.87)
	Middle/ Rich	273(48.15)	282 (53.13)
Household family size	<= 5	253 (44.62)	143 (26.84)
	>5	314 (55.38)	388 (73.16)
Counseling on breastfeeding by health provider during first 2 days of a birth	No	368 (64.90)	346 (65.25)
	Yes	199 (35.10)	185 (34.75)
Type of birth (Parity)	Single	562 (99.12)	526 (99.11)
	Multiple	5 (0.88)	5 (0.89)
ANC visit	No visit	151 (26.63)	155 (29.09)
	1-3	186 (32.80)	149 (28.15)
	>=4	230 (40.56)	227 (42.75)
PNC check within 2 months	No	513 (90.48)	475 (89.39)
	Yes	54 (9.52)	56 (10.61)
Place of delivery	Home	264 (46.56)	247 (46.43)
	Health facility	03 (53.44)	284 (53.57)
Caesarian delivery	No	530 (93.47)	497 (93.52)
	Yes	37 (6.53)	34 (6.48)

Table 3: Community level determinants of exclusive breast feeding in Ethiopia, EMDHS 2019 (n=531)

Variables	Categories	Unweighted Frequency n(%)	Weighted frequency (%)
Residence	Urban	121 (21.34)	124 (23.30)
	Rural	446 (78.66)	407 (76.70)
Contextual region	Agrarian	331 (58.38)	471 (88.74)
	Pastoralist	126 (22.22)	42 (7.94)
	City based	110 (19.40)	18(3.32)
Community ANC utilization	Low	226 (39.86)	234 (44.06)
	High	341 (60.14)	297 (55.94)
Community PNC utilization	Low	451 (79.54)	411(77.38)
	High	116 (20.46)	120 (22.62)
Community level poverty	High	278 (49.03)	242 (45.54)
	Low	289 (50.97)	289 (54.46)
Community women education	Low	310 (54.67)	286 (53.80)
	High	257 (45.33)	245 (46.20)

Table 4: Coverage of exclusive breastfeeding among infants aged under 6 months in Ethiopia, EMDHS 2019 (n=531)

Variables	Categories	Frequency	Percent
Infant breastfeed	Ever breastfeed (not currently)	12	2.05
	Never breastfeed	18	3.08
	Still breastfeeding	555	94.87
Initiation of breastfeeding	Immediately	426	75.13
	Within an hour	40	7.05
	1-24 Hrs	60	10.58
	24 Hrs	41	7.23
Exclusive breastfeed	No	96	16.93
	Yes	471	83.07

Random effects (measures of variation)

The results of this study also showed that the characteristics of the clusters where mothers resided would have an effect on exclusive breastfeeding practices. To choose the best model, the appropriate methods of model comparisons were done. Model with the lowest deviance, lowest AIC, and the highest log likelihood ratio was selected. As a result, Model IV was selected and better explain exclusive breast-feeding practices. At the empty model (Model I), the ICC value and its variance were 0.64 (ICC>5%) and 5.86 with 95%CI: 2.54- 13.48 at p-value <0.001, respectively, which indicates that 64% of the variation in exclusive breastfeeding was linked to community level factors.

The full model (model IV) showed that 34.42% (ICC =0.34 and variance = 1.73) the variations in exclusive breastfeeding accounts for individual and community level factors. In addition, the full model indicated that the PCV value was higher as compared to other candidate models. That is, 70.5% of variation of exclusive breastfeeding was explained by the combined factors at the individual and community levels. Moreover, the null model also had the highest median odds ratio (MOR) value (9.97) indicating when randomly select an individual from one cluster with a higher exclusive breastfeeding practice and the other cluster at lower exclusive breastfeeding practice, individuals at the cluster with a higher exclusive breastfeeding practice had 9.97 times higher odds of having an exclusive breastfeeding practice as compared with their counterparts.

Table 5: Random effects and model fitness of individual and community level factors associated with EBF among aged under 6-month infants in Ethiopia, EMDHS 2019 (n=531)

Characters		Null Model	Model I	Model II	Model III
Random effect	Variance	5.86(2.49)	5.22(2.86)	3.53(1.57)	1.73(1.56)
	ICC (%)	64%	61.34%	51.74%	34.42%
Measure of variation	PCV(%)	Reference	10.92%	39.76%	70.5%
	MOR	9.97	8.76	5.96	3.49
Model diagnostics	Log-likelihood	-154.46	-100.45	-135.43	-86.30
	Deviance	308.922	200.9	270.86	172.60
	AIC	312.92	226.90	288.86	212.60

Individual and community level determinants of exclusive breastfeeding practice

Fixed effects (measures of association)

Bi-variable multilevel logistic regression model was computed, and independent variables were selected for multivariable multilevel logistic regression model using stepwise variable selection method. Accordingly, time of breastfeeding initiation, birth interval, sex of head of the household, maternal education, region, household wealth index, caesarian delivery, place of residence, contextual region, community ANC utilization, Community PNC utilization, community level poverty, and community level education pass bi-variable multilevel logistic regression model.

The multilevel model was confirmed by intra-cluster correlation coefficient (ICC) of 45%, means of the variation in exclusive breastfeeding practices among infants age less than 6 months was due to the variation among clusters (EAs). Then four models were fitted hierarchically in this multi-level logistic regression model. Model I or Null model (without independent variables), model II (only with individual level independent variables), model III (only with community level independent variables), and model IV (both individual and community level independent variables).

To end, p-value $\leq$ 0.005 and odds ratio confidence interval not including the null value (OR=1) was used to select variables which had statistically significant association with EBF practice in the final model. As shown Table 5 below, the results of this finding showed that maternal education, household wealth index, place of residence, contextual region and community level poverty were factors significantly influencing exclusive breastfeeding practice among under 6-month infants.

The odds of EBF those mothers had higher educational level were less likely, 0.02(0.001, 0.64) as compared to non-educated mothers.

Mothers with higher education were negatively associated with exclusive breastfeeding practices to their babies as compared to mothers who had no formal education when other factors are remaining constant. Household wealth index was positively associated with EBF. Those infants from middle or rich families were 5.34 (AOR: 5.34; 95% CI: 1.022, 27.85) times more likely exclusive breastfeeding as compared to those infants from the poor families. The odds of EBF practice among rural mothers was 0.08 (AOR: 0.008; 95% CI: 0.01, 0.99) times less likely as compared to those living in urban areas. Contextual region was also significantly associated with exclusive breastfeeding practice. Accordingly, mothers who live in pastoralist regions were (AOR: 0.03; 95% CI: 0.003, 0.18) less likely to exclusively breastfeed their babies as compared to those mothers who live the agrarian regions. Community level poverty was negatively associated with EBF. Thus, mothers who live in community with low level poverty were 89% (AOR: 0.11; 95% CI: 0.018, 0.68) less likely to exclusive breastfeed compared to mothers who live in community with high level poverty.

Table 6: Multilevel logistic regression analysis of both individual and community level factors associated with exclusive breastfeeding among infants under 6 months of age in Ethiopia, EMDHS 2019

Variables	Categories	EBF No N (%)	EBF Yes N (%)	COR (95%CI)	Null Model	Model II AOR (95%CI)	Model III AOR (95%CI)	Model IV AOR (95%CI)
Time of breast-feeding initiation	<= 1h	33 (7.3)	417(92.7)	1		1		1
	>1h	21 (25.6)	60(74.4)	0.23(0.12, 0.42)		0.24(0.06,1.06)		0.50(0.13,1.96)
Birth interval	<= 24 months	10(15.2)	58(84.8)	1		1		1
	>24 months	27(7.5)	327(92.5)	2.21(1.02,4.79)		1.44(0.39,5.33)		0.87(0.26,2.90)
Sex of head of the household	Male	42(9.1)	426(90.9)	1		1		1
	Female	11(17.9)	51(82.1)	0.46(0.22, 0.94)		0.41(0.09,2.01)		1.46(0.32,6.63)
Maternal education	No education	27(10.1)	238(89.9)	1		1		1
	Primary	16(8.3)	176(91.7)	1.23(0.64, 2.36)		0.65(0.16,2.68)		0.78(0.15,4.05)
	Secondary	8(14.3)	48(85.7)	0.67(0.29, 1.57)		0.12(0.01,0.99) *		0.12(0.14, 1.05)
	Higher	3(15.9)	16(84.1)	0.59 (0.16, 2.16)		0.01(0.00,0.44) *		0.02(0.001,0.64) *
Religion	Orthodox	13(7.4)	167(92.6)	1		1		1
	Protestant	7(5.5)	122(94.5)	1.38 (0.54, 3.53)		1.17(0.13, 10.96)		1.62(0.26, 9.97)
	Muslim	33(15)	188(85)	0.46 (0.23, 0.89)		0.13(0.02, 0.87) *		0.56(0.11, 2.94)
Household wealth index	Poor	29 (11.8)	219 (88.2)	1		1		1
	Middle/Rich	24 (8.6)	258 (91.4)	1.43 (0.81, 2.51)		7.4 (1.55, 35.48) *		5.34(1.022,27.85)*
Caesarian delivery	No	49(9.8)	448(90.2)	1		1		1
	Yes	5(14.9)	29(85.1)	0.62 (0.23, 1.65)		1.72(0.19,15.25) *		2.81(0.64(12.36)
Residence	Urban	9 (6.9)	115 (93.1)	1			1	1
	Rural	45 (11.1)	362 (88.9)	0.6 (0.28, 1.28)			0.42 (0.08,2.17)	0.08 (0.01,0.99) *
Contextual region	Agrarian	31(6.6)	440 (93.4)	1			1	1
	Pastoralist	20 (47.3)	22 (52.7)	0.08 (0.04, 1.28)			0.01 (0.002,0.07) ***	0.03 (0.003, 0.18) ***
	City based	2 (13.8)	15 (86.2)	0.44 (0.11, 1.8)			0.25 (0.03,2.17)	0.51 (0.15, 16.80)
Community ANC utilization	Low	27 (11.4)	207 (88.6)	1			1	1
	High	27 (9.1)	270 (90.9)	1.28 (0.73, 2.26)			0.92 (0.24,3.53)	1.11 (0.244, 5.06)
Community PNC utilization	Low	45 (10.9)	366 (89.1)	1			1	1
	High	9 (7.4)	111 (92.6)	1.53 (0.72, 3.25)			1.20(0.29, 5.00)	0.76(0.15, 5.06)
Community level poverty	High	24 99.8)	218 (90.2)	1			1	1
	Low	30 (10.3)	259 (89.7)	0.94 (0.53, 1.66)			0.33 (0.08,1.37)	0.11 (0.018, 0.68)*
Community women education	Low	33 (11.4)	253 (88.6)	1			1	1
	High	21 (8.5)	224 (91.5)	1.39 (0.78, 2.47)			0.61 (0.15,2.50)	0.48(0.07,3.11)

DISCUSSION

The main objective of this study was to identify significant individual and community level factors that are affecting exclusive breastfeeding of infants under 6 months of age in Ethiopia.

The study revealed that the magnitude of exclusive breastfeeding among infants less than six months of age in Ethiopia was 83%. The multivariable multilevel logistic regression analysis showed that maternal education was one of the contributing factors for exclusive breastfeeding. This result showed that the higher educational status of mothers was

negatively associated with exclusive breastfeeding practice. This finding was consistent with other studies done in Ethiopia (31), and Ghana (32). Mostly uneducated mothers such as housewives are more likely to practice the exclusive breastfeeding as compared to educated and employed mothers (33). The possible reason may be uneducated mothers will have full time to be with her baby. Another reason may be higher educated mothers early return to the office, lack of support from the office, and have a short maternity leave (only four months in Ethiopia case). In addition, educated mothers may be relatively overloaded with office work, meetings, home activities, and will have limited contact time with infants.

The household wealth index was significantly associated with EBF. Those infants from middle or rich families were more likely practicing the exclusive breastfeeding as compared to those infants from the poor families. This result is concurrent with studies conducted in Ghana (32), India, Nigeria (34), and Ethiopia (14, 15, 22, 31, 35, 36). A possible reason is that mothers from middle- and high-income families may have better educational opportunities and greater awareness of the importance of exclusive breastfeeding.

In this study from community level variables, place of residence, contextual regions and community level poverty level showed statistically significant with EBF practice among infants under six months of age in Ethiopia. The study found that mothers living in rural areas had less likely exclusively breastfeeding practice compared to others living in urban areas. The result of this study was consistent with another studies done in Debreabor (20), Gurage zone (31), and Ethiopia (20). This may be due to the rural mothers less access to information, health facility, and lack of EBF education (20).

The result of this study showed that contextual region was a significant factor for EBF. Mothers who live in pastoralist regions were less likely to exclusive breastfeed compared to mothers found in Agrarian regions. The regional variations of exclusive breastfeeding also observed studies done in Ethiopia (22) and other African countries (35). The possible reason could be related that pastoralists may not have the awareness about the importance of exclusive breastfeeding due to lack of health care system, health education, and women empowerment. Furthermore, since pastoralists have mobile type of life style so they might not give attention for exclusive breastfeeding of their infants rather they may initiate cow milk early (29).

Furthermore, our findings revealed that community level poverty was a significant factor associated with exclusive breast feeding. Mothers from high poverty communities were more inclined to exclusively breastfeed their infants compared to their counterparts. This finding contrasts with results from other studies conducted in Ethiopia.

The reason behind the poor communities may be mothers with no formal education, housewives, and the unemployed. Therefore, they may get enough time to feed their infants as the WHO recommended.

Strength of the study

The study used both individual and community-level factors, an advanced statistical model, and the national representative survey data.

Limitations of the study

The primary drawback of the study was its inability to incorporate certain factors related to EBF practice, such as preceding birth intervals, the birth size, the mother's occupation, and the mother's knowledge of the importance of EBF, due to unavailability in the dataset, which could potentially be linked to EBF but were not included in the study. The other limitation of the survey was its reliance on a 24-hour recall method for assessing Exclusive Breastfeeding, which could have resulted in recall or measurement bias. Due to the cross-sectional nature of the data, it was not feasible to determine the causal connection between variables and exclusive breastfeeding practice. Finally, since the sample size is small most of the indicators become insignificant and the confidence interval is wide.

Conclusion and recommendation

In this study, we found that mothers' educational level, wealth index, place of residence, contextual region, and community poverty level were significantly associated factors with exclusive breastfeeding practice among infants under six months of age in Ethiopia. Therefore, educated and employed mothers having more maternity leave, becoming reach family, and living urban educated mothers having more time for breastfeeding are highly recommended infants exclusively breastfed. Furthermore, creating awareness about poverty at the community level may help enhance exclusive breastfeeding practices.

Abbreviations

EBF: Exclusive Breast Feeding ; WHO: World Health Organization ; ANC: Antenatal Care ; PNC: Postnatal Care ; EMDHS: Ethiopian Mini Demographic Health Survey; SNNP: South Nation Nationalities and People; CSA: Central Statistical Agency; EA: Enumeration area ; VIF: variance inflation factor ; ICC: Intra Cluster Correlation ; MOR: Median Odds Ratio; PCV: Proportional Change in Variance ; AIC: Akaike Information Criteria ; LL: log-likelihood

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Author Contributions

BMG did all things such as data management, performed data analysis, drafted, edited and finalized the manuscript.

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Availability of data and materials

The dataset used for the current study was drawn from 2019 EMDHS which is publicly available on <https://dhsprogram.com/data/available-datasets.cfm>, and the dataset used for the final analysis during the current study can be obtained from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate

Permission was obtained to use the EDHS data from measure DHS (available from <https://www.dhsprogram.com/Data>) in international program. The data is publicly available and has no personal identifiers.

Consent for publication

Not applicable

Competing interests

The author declared that they have no competing interest

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REFERENCES

1. WHO U. WHO| Increasing commitment to breastfeeding through funding and improved policies and programmes: Global breastfeeding scorecard 2019. Published online 2019. WHO; 2019.
2. WHO G. Global strategy for infant and young child feeding. 2003.
3. Bernardo H, Cesar V, Organization WH. Long-term effects of breastfeeding: a systematic review. 2013.
4. Hanieh S, Ha TT, Simpson JA, Thuy TT, Khuong NC, Thoang DD, et al. Exclusive breast feeding in early infancy reduces the risk of inpatient admission for diarrhea and suspected pneumonia in rural Vietnam: a prospective cohort study. BMC Public Health. 2015;15:1-10.
5. Victora CG, Bahl R, Barros AJ, França GV, Horton S, Krasevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. The lancet. 2016;387(10017):475-90.
6. Agunbiade OM, Ogunleye OV. Constraints to exclusive breastfeeding practice among breastfeeding mothers in Southwest Nigeria: implications for scaling up. International breastfeeding journal. 2012;7:1-10.
7. Organization WH. Baby-friendly hospital initiative: revised, updated and expanded for integrated care. 2009.
8. Organization WH. Guideline: protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services: World Health Organization; 2017.
9. Organization WH. Global breastfeeding scorecard, 2019: increasing commitment to breastfeeding through funding and improved policies and programmes. World Health Organization; 2019.
10. Cai X, Wardlaw T, Brown DW. Global trends in exclusive breastfeeding. International breastfeeding journal. 2012;7(1):1-5.
11. Bhattacharjee NV, Schaeffer LE, Marczak LB, Ross JM, Swartz SJ, Albright J, et al. Mapping exclusive breastfeeding in Africa between 2000 and 2017. Nature medicine. 2019;25(8):1205-12.
12. EPHI I. Ethiopian public health Institute (EPHI) [Ethiopia] and ICF. Ethiopia Mini Demographic and Health Survey 2019: Key Indicators. 2019.
13. Azeze GA, Gelaw KA, Gebeyehu NA, Gesese MM, Mokonnen TM. Exclusive breastfeeding practice and associated factors among mothers in Boditi Town, Wolaita Zone, Southern Ethiopia, 2018: a community-based cross-sectional study. International journal of pediatrics. 2019;2019.
14. Gebremedhin T, Geberu DM, Atnafu A. Less than one-fifth of the mothers practised exclusive breastfeeding in the emerging regions of Ethiopia: a multilevel analysis of the 2016 Ethiopian demographic and health survey. BMC Public Health. 2021;21(1):1-13.
15. Hagos A, Tsadik M, Belachew AB, Tesfahunegn A. Individual and community-level factors influencing optimal breastfeeding: A multilevel analysis from a na-

- tional survey study of Ethiopia. *Plos one*. 2021;16(4):e0241428.
16. Jebena DD, Tenagashaw MW. Breastfeeding practice and factors associated with exclusive breastfeeding among mothers in Horro District, Ethiopia: A community-based cross-sectional study. *Plos one*. 2022;17(4):e0267269.
 17. Lenja A, Demissie T, Yohannes B, Yohannis M. Determinants of exclusive breastfeeding practice to infants aged less than six months in Offa district, Southern Ethiopia: a cross-sectional study. *International breastfeeding journal*. 2016;11:1-7.
 18. Mamo K, Dengia T, Abubeker A, Girmaye E. Assessment of exclusive breastfeeding practice and associated factors among mothers in west Shoa zone, Oromia, Ethiopia. *Obstetrics and gynecology international*. 2020;2020.
 19. Mekebo GG, Argawu AS, Likassa HT, Ayele W, Wake SK, Bedada D, et al. Factors influencing exclusive breastfeeding practice among under-six months infants in Ethiopia. *BMC Pregnancy and Childbirth*. 2022;22(1):1-10.
 20. Muluneh MW. Determinants of exclusive breastfeeding practices among mothers in Ethiopia. *Plos one*. 2023;18(2):e0281576.
 21. Shifraw T, Worku A, Berhane Y. Factors associated exclusive breastfeeding practices of urban women in Addis Ababa public health centers, Ethiopia: a cross sectional study. *International breastfeeding journal*. 2015;10(1):1-6.
 22. Tsegaw SA, Dawed YA, Amsalu ET. Individual level and community level factors affecting exclusive breast feeding among infants under-six months in Ethiopia using multilevel analysis. *Italian Journal of Pediatrics*. 2021;47(1):1-13.
 23. Woldeamanuel BT. Trends and factors associated to early initiation of breastfeeding, exclusive breastfeeding and duration of breastfeeding in Ethiopia: evidence from the Ethiopia demographic and health survey 2016. *International breastfeeding journal*. 2020;15(1):1-13.
 24. Wondim A, Techane MA, Wubneh CA, Assimamaw NT, Belay GM, Tamir TT, et al. Major maternal related determinants of non-breastfeeding among mothers in Ethiopia: A multilevel analysis from DHS Ethiopia 2016. *Plos one*. 2023;18(6):e0286662.
 25. Tewabe T, Mandesh A, Gualu T, Alem G, Mekuria G, Zeleke H. Exclusive breastfeeding practice and associated factors among mothers in Motta town, East Gojjam zone, Amhara Regional State, Ethiopia, 2015: a cross-sectional study. *International breastfeeding journal*. 2016;12:1-7.
 26. Shitie A, Tilahun A, Olijira L. Exclusive breastfeeding practice and associated factors among mothers of infants age 6 to 12 months in Somali region of Ethiopia. *Scientific Reports*. 2022;12(1):19102.
 27. Sinshaw Y, Ketema K, Tesfa M. Exclusive breast feeding practice and associated factors among mothers in Debre Markos town and Gozamen district, east Gojjam zone, north west Ethiopia. *J Food Nutr Sci*. 2015;3(5):174-9.
 28. Hunegnaw MT, Gezie LD, Teferra AS. Exclusive breastfeeding and associated factors among mothers in Gozamin district, northwest Ethiopia: a community based cross-sectional study. *International breastfeeding journal*. 2017;12:1-8.
 29. Belachew AB, Kahsay AB, Abebe YG. Individual and community-level factors associated with introduction of prelacteal feeding in Ethiopia. *Archives of Public Health*. 2016;74(1):1-11.
 30. Demographic E. Addis Ababa, Ethiopia, and Rockville. Maryland, MA, USA: CSA and ICF. 2016.
 31. Bisrat Z, Kenzudine A, Bossena T. Factors associated with early initiation and exclusive breastfeeding practices among mothers of infant's age less than 6 months. *J Pediatr Neonatal Care*. 2017;7(3):00292.
 32. Asare BY-A, Preko JV, Baafi D, Dwumfour-Asare B. Breastfeeding practices and determinants of exclusive breastfeeding in a cross-sectional study at a child welfare clinic in Tema Manhean, Ghana. *International breastfeeding journal*. 2018;13:1-9.
 33. Adugna B, Tadele H, Reta F, Berhan Y. Determinants of exclusive breastfeeding in infants less than six months of age in Hawassa, an urban setting, Ethiopia. *International breastfeeding journal*. 2017;12(1):1-8.
 34. Agho KE, Dibley MJ, Odiase JI, Ogbonmwan SM. Determinants of exclusive breastfeeding in Nigeria. *BMC pregnancy and childbirth*. 2011;11:1-8.

35. Manyeh AK, Amu A, Akpakli DE, Williams JE, Gya-pong M. Estimating the rate and determinants of exclusive breastfeeding practices among rural mothers in Southern Ghana. *International Breastfeeding Journal*. 2020;15(1):1-9.
36. Ogbo FA, Dhami MV, Awosemo AO, Olusanya BO, Olusanya J, Osuagwu UL, et al. Regional prevalence and determinants of exclusive breastfeeding in India. *International breastfeeding journal*. 2019;14(1):1-12.